A new snakefly species of the family Inocelliidae (Insecta: Raphidioptera) from China

Changchun LI[1], Xingyue LIU[2]①

1. *College of Life Science and Technology, Hubei Engineering University, Xiaogan, Hubei 432000, China*
2. *Department of Entomology, China Agricultural University, Beijing 100193, China*

Abstract: We describe a new species in the snakefly family Inocelliidae from Guizhou, China, namely *Inocellia wenii* **sp. nov.** This new species can be assigned to the *Inocellia crassicornis* species-group based on the male gonocoxite 9 wider than long. It mostly resembles *Inocellia shinohara* Aspöck, Liu & Aspöck, 2009 that is endemic to Taiwan, but can be distinguished from the latter species by the male gonapophyses 9 proximally with a pair of subtriangular sclerotized lobes that are associated with the endophallus. The present finding represents the second snakefly species recorded from Guizhou. A key to species of the *I. crassicornis* group is presented.

Key words: *Inocellia wenii*; taxonomy; key

中国盲蛇蛉科一新种记述（昆虫纲：蛇蛉目）

李长春[1]，刘星月[2]①

1. 湖北工程学院生命科学技术学院，湖北 孝感 432000；2. 中国农业大学植物保护学院昆虫学系，北京 100193

摘要：记述采自中国贵州的蛇蛉目盲蛇蛉科 1 新种：文一盲蛇蛉 *Inocellia wenii* **sp. nov.**，该新种是贵州省发现的第 2 个蛇蛉目物种，因其雄第 9 生殖基节宽大于长而被归于粗角盲蛇蛉种团。该新种与台湾特有种荻原盲蛇蛉 *I. shinohara* 近似，但其第 9 生殖叶基部具 1 对与阳茎连接的骨片，可与后者区分。文中还编制了粗角盲蛇蛉种团的分种检索表。

关键词：盲蛇蛉属；分类；检索表

Introduction

Raphidioptera (snakeflies) is the smallest order based on species number in the Holometabola, with only about 250 extant species (Oswald 2021). The snakefly fauna of China is becoming one of the spectacular faunal components with a regionally high species diversity and endemism owing to a series of taxonomic works in the last decade (Aspöck *et al*. 2009; Liu *et al*. 2009a, b, 2010a, b, 2012, 2013, 2014, 2018a, b; Shen *et al*. 2019; Shen & Liu 2021). Currently, there are five genera and 34 species of Raphidioptera from China. Among them, three genera and 23 species belong to Inocelliidae, of which one genus and 21 species

---

Accepted 6 December 2021. Published online 27 January 2022. Published 25 March 2022.

① Corresponding author, E-mail: xingyue_liu@yahoo.com of these inocelliids are endemic to China. Despite the relatively rich species diversity, it is well known that snakeflies are rarely collected in the field in China. Thus, any new species, new records, and new specimens are important for increasing our knowledge of snakefly diversity and evolution in China.

Here we describe a new species of the family Inocelliidae, namely *Inocellia wenii* **sp. nov.**, based on a male specimen collected from Mt. Fanjingshan, Guizhou, China. A key to the species of the *Inocellia crassicornis* species-group, to which this new species is assigned, is provided.

Material and methods

The type specimen of this new species is deposited in the Entomological Museum of China Agricultural University (CAU), Beijing. Preparations of the genital segments were made by macerating the apex of the abdomen in a hot, saturated KOH solution for 5–6 min. After rinsing the KOH with acetic acid and water, the apex of the abdomen was transferred to glycerine for further dissection and examination. The terminology of the genitalia generally follows Aspöck & Aspöck (2008).

Taxonomy

Genus *Inocellia* Schneider, 1843

Inocellia Schneider, 1843: 84. Type species: *Raphidia crassicornis* Schummel, 1832: 15 (monotypy).

Note. See diagnosis of *Inocellia* in Liu *et al*. (2009a, 2010a, b, 2012, 2014).

Distribution. Europe (Austria, Czech Republic, European part of Russia, Finland, Germany, Italy, Netherlands, Poland, Sweden); Asia (Afghanistan, Armenia, Bhutan, China, India, Japan, Mongolia, North Korea, Pakistan, Russia Far East, Thailand).

The *Inocellia crassicornis* species-group

Note. See diagnosis of this species-group in Liu *et al*. (2010a).

Distribution. Widespread in East Asia, with one species also from western Europe.

Inocellia wenii sp. nov. (Figs 1, 2)

Description. Male. Body length 10.4 mm; forewing length 8.7 mm, hindwing length 7.5 mm.

Head (Fig. 1) subquadrate, black, clypeus yellowish brown, vertex with a pair of indistinct yellowish brown vittae medially. Antennal sclerite (torulus) pale yellowish brown; antenna brown, but pedicel and proximal three flagellomeres yellowish brown. Mouthparts blackish brown except for maxillary palps pale yellowish brown.

Thorax (Fig. 1) black; meso- and metanota each with a yellow marking on scutellum, ventrolateral portion of meso- and metathorax yellow. Legs yellow with yellowish setae; all legs with tarsomeres 2–5 brown; metatibiae slightly darker on distal half. Wings hyaline, pterostigma and veins dark brown. RP with one forked vein and one simple vein running to wing margin. MA distally bifurcated.

Abdomen with pregenital segments dorsally blackish brown and ventrally brown; each pregenital segment with an indistinct narrow yellowish transverse marking on posterior margins of tergum and sternum; genital segments blackish brown except yellow ectoproct. Gonocoxite 9 (Fig. 2A) shell-like, suboval, much wider than long, posteroventrally slightly produced on inner side and with a tuft of bristles. Gonostylus 9 (Figs 2B, 2C) present on dorsomedian portion of inner side of gonocoxite 9, thumb-like, directed dorsad, distally with a few stiff bristles. A tuft of bristles present close to and anteriad of gonostylus 9. Gonapophyses 9 (pseudostyli) (Fig. 2B) paired and foliate in caudal view, proximally with a pair of subtriangular sclerotized lobes (Figs 2B, 2C) that are associated with proximal part of endophallus. Complex of fused gonocoxites, gonapophyses, and gonostyli 10 (Figs 2B, 2C) small, proximal portion flattened, distal projection curved dorsad with tip slightly notched. Fused gonocoxites 11 (gonarcus) (Figs 2B, 2C) shield-like, slightly narrowed ventrad; dorsal margin in caudal view slightly concave and feebly produced posteriad in lateral view, ventral margin slightly produced medially in caudal view; a pair of flat, tongue-shaped projections present medially and near dorsal margin. Endophallus (Figs 2B, 2C) short, distally produced into a slightly sclerotized, conical structure; two pairs of tufts of bristles present lateral to conical apex, dorsal tuft with more and longer bristles than ventral tuft. Ectoproct (Fig. 2A) nearly rectangular in lateral view. Hypandrium internum (Figs 2C, 2E) small, all lobes narrow.

Female. Unknown.

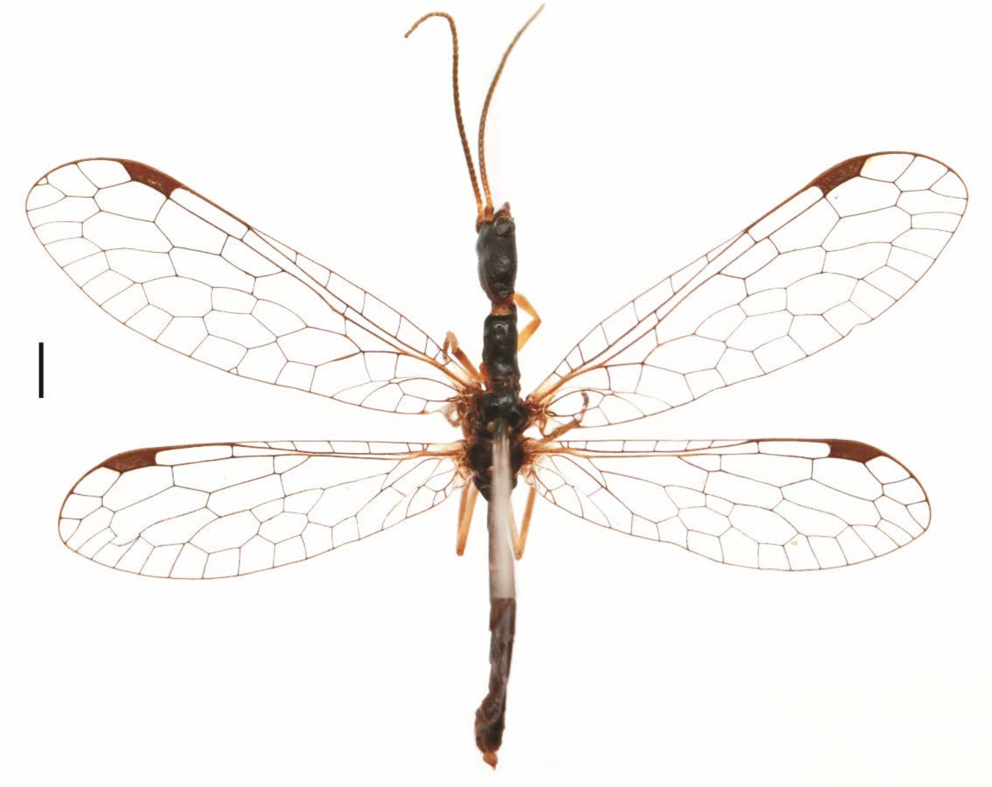

Figure 1. *Inocellia wenii* **sp. nov.**, holotype, ♂, habitus photo. Scale bar = 1.0 mm.

Holotype. ♂, **China**, Guizhou, Mt. Fanjingshan, 1600 m, 05-VII-2008, light trap, Weni CHOU (CAU).

Etymology. This new species is dedicated to Dr. Weni CHOU who collected and kindly gifted the valuable specimen of this new species.

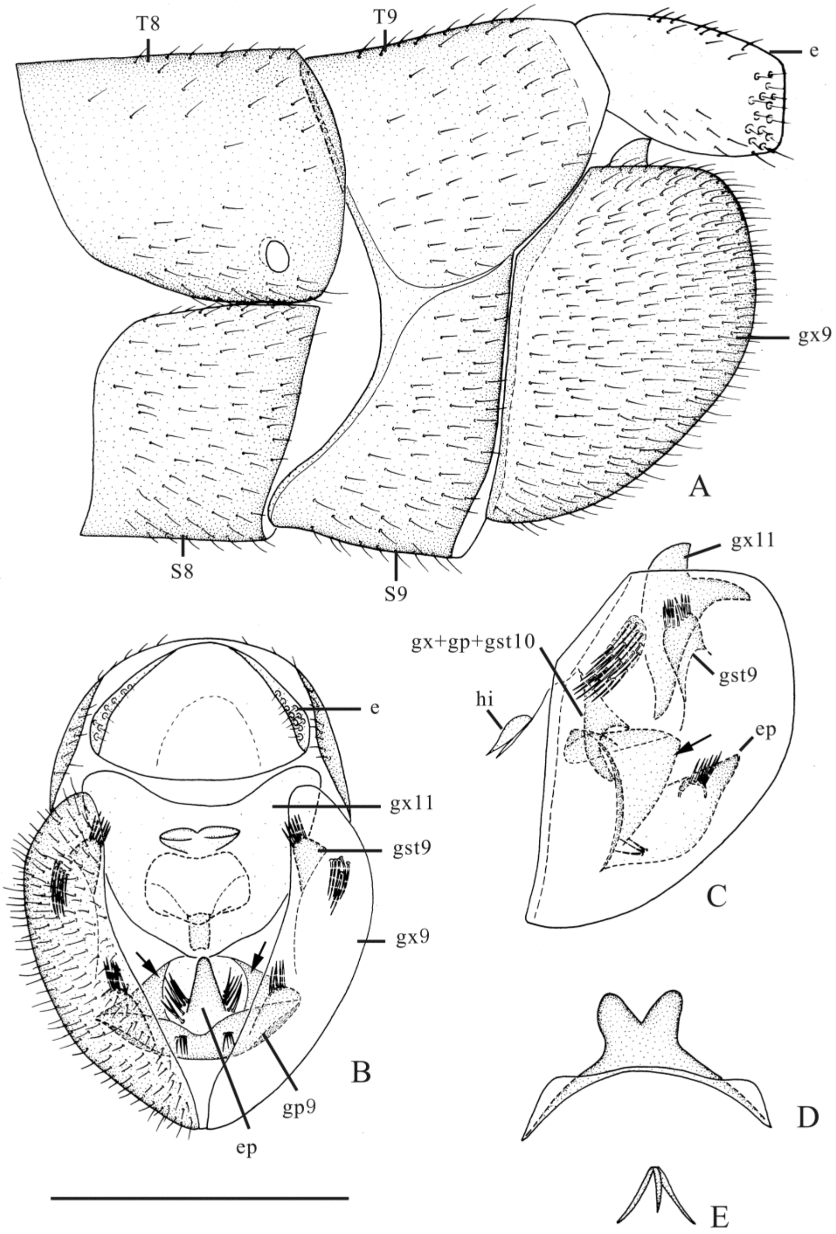

Figure 2. *Inocellia wenii* **sp. nov.**, holotype, ♂. A. Genitalia, lateral view; B. Genitalia, caudal view; C. Genital sclerites showing internal structures, lateral view; D. Fused gonocoxites 11 (gonarcus), dorsal view; E. Hypandrium internum, ventral view. Abbreviations: e – ectoproct; ep – endophallus; gp9 – gonapophyses 9 (pseudostylus); gst9– gonostylus 9; gx9 – gonocoxite 9; gx+gp+gst10 – complex of fused gonocoxites, gonapophyses, and gonostyli 10 (paramere); gx11 – fused gonocoxites 11 (gonarcus); S8, 9 – sternum 8 and 9; T8, 9 – tergum 8 and 9. Scale bar = 0.5 mm.

Diagnosis. This species is characterized in the male by the dorsally directed, thumb-like gonostylus 9, the gonapophyses 9 (pseudostyli) proximally with a pair of subtriangular sclerotized lobes, the fused gonocoxites 11 (gonarcus) medially with a pair of flat, tongue-shaped projections, and the endophallus with a sclerotized conical apex.

Remarks. This new species belongs to the *I. crassicornis* group by the male gonocoxite 9 being wider than long (Liu *et al*. 2010a). Based on the presence of posterior projections on male fused gonocoxites 11, this new species appears to be closely related to *I. digitiformis*, *I. fujiana* and *I. shinohara*. Most of the other male genital characters in these four species are also very similar, such as the distinctly prominent gonostylus 9 distally with a bristle tuft, and the presence of bristles anteriad on gonostylus 9 and on posteroventral portion of gonocoxite 9. However, *I. wenii* **sp. nov.** can be distinguished from *I. digitiformis* by the posterior projections on male fused gonocoxites 11 present as a pair of closely spaced, tongue-shaped projections; in the latter species these projections are widely spaced and slenderly digitiform (Liu *et al*. 2010a). This new species differs from *I. fujiana* also by the shape of the posterior projections on male fused gonocoxites 11; in *I. fujiana* these projections are proximally fused with each other and distally separated, short, and digitiform, but sometimes reduced (Liu *et al*. 2010a). Notably, *I. wenii* **sp. nov.** mostly resembles *I. shinohara* from Taiwan not only by their similar male fused gonocoxites 11 but also by the endophallus distally specialized into a conical structure. Nevertheless, the male gonapophyses 9 proximally have a pair of subtriangular sclerotized lobes that are associated with the proximal part of endophallus in this new species, but these sclerites are absent in *I. shinohara* (Aspöck *et al*. 2009).

Key to species of the *Inocellia crassicornis* species-group based on male characters

1. Fused gonocoxites 11 (gonarcus) with paired or unpaired posterior projections (Liu *et al*. 2010a: fig. 31) ··· 2

-. Fused gonocoxites 11 (gonarcus) without posterior projections (Liu *et al*. 2010a: fig. 6)····················· 6

2. Posterior projections of fused gonocoxites 11 (gonarcus) closely spaced or proximally fused with each other (Li *et al*. 2010a: fig. 32)·· 3

-. Posterior projections of fused gonocoxites 11 (gonarcus) paired, widely spaced, slenderly digitiform (Liu *et al*. 2010a: fig. 26)·· 5

3. Posterior projections of fused gonocoxites 11 (gonarcus) in dorsal view tongue-shaped, forming a deeply V-shaped incision medially; endophallus distally produced into an acutely conical structure (Aspöck *et al*. 2009: fig. 3)·· 4

-. Posterior projections of fused gonocoxites 11 (gonarcus) in dorsal view short digitiform or reduced, forming a shallow incision medially; endophallus distally obtuse (Liu *et al*. 2010a: figs 38, 40, 43)········ ···*I. fujiana* Yang

4. Gonostylus 9 short, with rounded tip (Fig. 2C); gonapophyses 9 proximally with a pair of subtriangular sclerotized lobes that are associated with proximal part of endophallus (Figs 2B, 2C)····· *I. wenii* **sp. nov.**

-. Gonostylus 9 long and tapering distad; gonapophyses 9 proximally without sclerotized lobes (Aspöck *et al*. 2009: fig. 5)·····························*I. shinohara* Aspöck, Liu & Aspöck

5. Gonostylus 9 well-developed; fused gonocoxites 11 (gonarcus) with posterior projections located near dorsal margin; four bristle tufts present on endophallus (Liu *et al*. 2010a: fig. 24)···························· ································· *I. digitiformis* Liu, Aspöck, Yang & Aspöck

-. Gonostylus 9 feebly developed; fused gonocoxites 11 (gonarcus) with posterior projections located at middle; bristles on endophallus reduced (Liu *et al*. 2018: fig. 3) ···

··· *I. occidentalis* Liu, Lyu, Aspöck & Aspöck

6. Endophallus proximally with a pair of processes dorsolaterally (Liu *et al*. 2010a: fig. 6)··················· 7

-. Endophallus proximally without process (Liu *et al*. 2010a: fig. 15)··· 9

7. Endophallus distally with a pair of bristle tufts (Aspöck *et al*. 1991: fig. 2499) ········*I. japonica* Okamoto

-. Endophallus distally with only two bristles or none (Liu *et al*. 2010a: fig. 6) ································ 8

8. Complex of fused gonocoxites, gonapophyses, and gonostyli 10 (paramere) with distal projection not concave at tip; endophallus dorsally without scabrous region (Liu *et al*. 2010a: fig. 6) ······················ ··· *I. biprocessus* Liu, Aspöck, Yang & Aspöck

-. Complex of fused gonocoxites, gonapophyses, and gonostyli 10 (paramere) with distal projection concave at tip; endophallus dorsally with a scabrous region (Shen & Liu 2021: fig. 13)································ ·· *I. yulongensis* Shen & Liu

9. Gonocoxite 9 with rows of bundles anterior to stylus (Aspöck *et al*. 1991: fig. 2502)························· ···*I. taiwana* Aspöck & Aspöck

-. Gonocoxite 9 without bristle tuft anteriad gonostylus 9, but sometimes with a rather small process posteriad gonostylus 9 (Liu *et al*. 2012: fig. 10)··· 9

10. Gonarcus subtrapezoidal in caudal view; endophallus with two pairs of bristle tufts (Liu *et al*. 2010a: figs 15, 17) ·· *I. crassicornis* (Schummel)

-. Gonarcus subquadrate in caudal view; endophallus with only one pair of tufts on dorsal surface (Liu *et al*. 2012: fig. 9)··· *I. nigra* Liu, Aspöck, Zhang & Aspöck

Discussion

Inocellia wenii **sp. nov.** is the second snakefly species described from Guizhou Province after the finding of *I. elegans* Liu, Aspöck, Yang & Aspöck (Liu *et al*. 2009a). Notably, both of these two species are distributed from Mt. Fanjingshan. It is remarkable that the new species mostly resembles the Taiwanese endemic species *I. shinohara* although these two species are far distant in distribution. Nevertheless, this is not the only case known so far in *Inocellia*. The recently discovered species *I. yulongensis* from northwestern Yunnan, southwestern China is closely related to *I. biprocessus* from Shandong, northern China and *I. japonica* from Japan. Future work may focus on testing the sister-group relationships among these putative closely related species and figure out the spatio-temporal scenario of the speciation of *Inocellia*.

Acknowledgements

We are very grateful to Dr. Weni CHOU for collecting and gifting this specimen. This research was supported by the National Natural Science Foundation of China (31672322) and the Chutian Scholars Program.

References

Aspöck U & Aspöck H. 2008. Phylogenetic relevance of the genital sclerites of Neuropterida (Insecta: Holometabola). *Systematic Entomology*, 33: 97–127.

Aspöck U, Liu XY & Aspöck H. 2009. *Inocellia shinohara* n. sp. — Überraschender Nachweis einer zweiten Spezies der Familie Inocelliidae in Taiwan (Raphidioptera). *Entomologische Nachrichten und Berichte*, 53: 115–119.

Liu XY, Aspöck H & Aspöck U. 2014. *Inocellia rara* sp. nov. (Raphidioptera: Inocelliidae), a new snakefly species from Taiwan, with remarks on systematics and biogeography of the Inocelliidae of the island. *Zootaxa*, 3753: 226–232.

Liu XY, Aspöck H, Bi WX & Aspöck U. 2013. Discovery of Raphidioptera (Insecta: Neuropterida) in Hainan Island, China, with description of a new species of the genus *Inocellia* Schneider. *Deutsche Entomologische Zeitschrift*, 60: 59–64.

Liu XY, Aspöck H, Yang D & Aspöck U. 2009a. *Inocellia elegans* sp. n. (Raphidioptera, Inocelliidae) — A new and spectacular snakefly from China. *Deutsche Entomologische Zeitschrift*, 56: 319–323.

Liu XY, Aspöck H, Yang D & Aspöck U. 2009b. Discovery of *Amurinocellia* H. Aspöck & U. Aspöck (Raphidioptera: Inocelliidae) in China, with description of two new species. *Zootaxa*, 2264: 41–50.

Liu XY, Aspöck H, Yang D & Aspöck U. 2010a. The *Inocellia crassicornis* species group (Raphidioptera: Inocelliidae) in mainland China, with description of two new species. *Zootaxa*, 2529: 40–54.

Liu XY, Aspöck H, Yang D & Aspöck U. 2010b. Species of the *Inocellia fulvostigmata* group (Raphidioptera: Inocelliidae) from China. *Deutsche Entomologische Zeitschrift*, 57: 223–232.

Liu XY, Aspöck H, Zhang WW & Aspöck U. 2012. New species of the snakefly genus *Inocellia* Schneider, 1843 (Raphidioptera: Inocelliidae) from Yunnan, China. *Zootaxa*, 3298: 43–52.

Liu XY, Lyu YN, Aspöck H & Aspöck U. 2018a. Discovery of a new species of Inocelliidae (Insecta: Raphidioptera) in an altitude of nearly 3500 m in China. *Zootaxa*, 4471: 585–589.

Liu XY, Lyu YN, Aspöck H & Aspöck U. 2018b. New species of the snakefly genus *Mongoloraphidia* (Raphidioptera: Raphidiidae) from China. *Zootaxa*, 4527: 87–96.

Oswald JD. 2021. Neuropterida Species of the World. *Lacewing Digital Library, Research Publication* No. 1. Available from: http://lacewing.tamu.edu/SpeciesCatalog/Main (Last accessed 5 November 2021)

Schneider WG. 1843. *Monographia generis Rhaphidiae Linnaei. Continens et novas de huius generis singulis speciebus institutas observationes, et inegram omnium, quae hucusque inventae sunt, specierum descriptionem*. Grass, Barth & Co., Vratislaviae, 96 pp.

Schummel TE. 1832. *Versuch einer genauen Beschreibung der in Schlesien einheimischen Arten der Gattung Raphidia, Linn*. Eduard Pelz, Breslau, 16 pp.

Shen RR & Liu XY. 2021. New snakeflies of the genus *Inocellia* Schneider, 1843 (Raphidioptera: Inocelliidae) from the Hengduan Mountains, China. *Journal of Asia-Pacific Entomology*, 24: 1070–1076.

Shen RR, He YN, Pan ZH & Liu XY. 2019. Discovery of Raphidioptera (Insecta: Neuropterida) in Xizang, China, with description of a new species of *Inocellia* Schneider. *Zootaxa*, 4712: 403–412.